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COMPLETE SPECIFICATION

Improvements relating to the Production of Motor Fuel

We, THE BRITISH PETROLEUM COMPANY LIMITED (previously known as Anglo-Iranian Oil Company Limited), of Britannic House, Finsbury Circus, London, E.C.2, a British joint-stock Corporation and FREDERICK WILLIAM BERTRAM PORTER, of the Company's Research Station, Chertsey Road, Sunbury-on-Thames, Middlesex, and of British nationality, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to the production of motor fuel, and more particularly to the production of a high quality motor gasoline from certain polymers produced in the treatment of gasoline obtained by the steam cracking of petroleum naphthas.

When a petroleum naphtha having a boiling range, for example, of 100—200° C. A.S.T.M. is cracked in the presence of steam at elevated temperature for the production of ethylene and propylene, a cracked naphtha is also produced. It is usual to subject this cracked naphtha to thermal-polymerisation at a low temperature in order to stabilise it against gum formation, and the resulting gasoline boiling below 200° C. is suitable for use as a motor gasoline without further treatment. During this operation, a higher boiling polymer is formed amounting to between 10 and 16% by weight of the cracked naphtha, and the principal object of the present invention is to utilize this polymer or a portion thereof for the formation of a further quantity of gasoline which is of high quality.

It has now been discovered that said polymer or a part thereof may be catalytically hydrogenated at elevated temperature and the hydrogenated product fractionated to yield a gasoline fraction of high quality. It has also been discovered that a fraction rich in aromatics and boiling above the gasoline range may be separated from the hydrogenated product.

According to the invention therefore, said polymer or a part thereof is catalytically hydrogenated at elevated temperature and pressure and the product of the hydrogenation process is fractionated to yield a gasoline fraction.

According to a further feature of the invention, the product of the hydrogenation process is fractionated to yield a gasoline fraction and a higher boiling fraction rich in aromatics.

According to yet another feature of the invention, a lower boiling fraction of said polymer, for example a fraction having a boiling range of 200 to 300° C., may be subjected to the hydrogenation process.

The conditions of the hydrogenation process may vary within the following limits:

Temperature	650—850° F.
Pressure	500—1000 p.s.i. ga.
Space Velocity	up to 10 v/v/hr. of liquid feedstock
Gas Recycle Rate	up to 10,000 SCF/B

The catalyst may be any known hydrogenation catalyst but a catalyst consisting of the oxides of cobalt and molybdenum supported on alumina is preferred.

Methods of carrying the invention into effect will now be described by way of example only.

EXAMPLE 1.

A steam cracked naphtha was subjected to polymerisation treatment at a pressure of 375 p.s.i.g., a temperature of 200° C. and a residence time of 8 hours. The polymer, which amounted to about 16% wt. on feeds was hydrogenated over a catalyst consisting of the oxides of cobalt and molybdenum on alumina at a pressure of 1000 p.s.i.g., a temperature of 780° F., a space velocity of liquid polymer of 1.0 v/v/hr. and a gas recycle rate of 4000 SCF/B.

The steam cracked naphtha had the following properties before and after polymerisation:

[A. 1000000]

	Before Polymerisation	After Polymerisation and removal of ca. 16% wt. Polymer
Specific Gravity @ 60°F./60°F.	0.7865	0.8085
A.S.T.M. Distillation:		
I.B.P.	23	37
2%	28	51
5%	35	60
10%	44	70
20%	63	85
30%	86	97.5
40%	103.5	108.5
50%	123	120
60%	137	131
70%	151.5	141
80%	164.5	152
90%	188	165
F.B.P.	199	184
Bromine Number	77.5	45
Octane Number (Motor Method)	82.2	80
" " (Research Method clear)	96.5	94.1

The hydrogenated polymer had the following properties:—

Specific Gravity A.S.T.M. Distillation	@ 60° F/60° F.	0.8835
I.B.P.	° C.	44
2%	"	61
5%	"	71.5
10%	"	85
20%	"	103
30%	"	124
40%	"	148.5
50%	"	170
60%	"	191
70%	"	210
80%	"	230.5
90%	"	257
F.B.P.	"	325
Bromine Number		3.3
Aniline Point	° C.	—17
Diesel Index		0.4
Hydrocarbon Type Analysis (A.S.T.M. .875)		
Aromatics	% vol.	71
Olefins	"	3
Naphthenes & Paraffins	"	26

The hydrogenated polymer was distilled to yield fractions boiling below and above 200° C., such fractions having the following 5 properties:

	I.B.P.— 200°C.	200°C.— F.B.P.
	Fraction	Fraction
Yield, % volume	70	30
Octane Number (Research Method clear)	98.1	—
(Micro-Analytical Method)	F.A.I. Method	F.I.A. A.S.T.M.
Hydrocarbon Type Analysis		
Aromatics	57.5	98.0
Olefins	1.0	1.0
Paraffins & Naphthenes	41.5	2.0

EXAMPLE 2.

The same steam cracked naphtha as in Example 1 was subjected to polymerisation treatment under the same conditions as in Example 1. A distillate fraction of the polymer was then hydrofined under the following conditions:—

Pressure	p.s.i.g.	700
Temperature	° F.	780
Space Velocity	v/v/hr.	1.0
Gas Recycle Rate	SCF/B.	4000

The polymer distillate fraction had the following properties before and after hydrofining:—

	Feedstock Distillate Polymer	Hydrogenated Product
Yield on Total Polymer % wt.	50	—
Yield on Steam Cracked Naphtha	8	—
Specific Gravity @ 60°F./60°F.	0.9725	0.9010
A.S.T.M. Distillation:		
I.B.P.	194	52.5
2%	212	64
5%	217.5	78
10%	220	97.5
20%	222	158
30%	227	192
40%	232	214
50%	237	225
60%	242.5	234
70%	251	244.5
80%	259.5	259.5
90%	273	283.5
F.B.P.	277	Cut
Bromine Number	105	2.8
Octane Number (Research Method clear)	—	97.4
Hydrocarbon Type Analysis:		
F.I.A. Method		
Aromatics % vol.	—	71.6
Olefins	—	1.2
Naphthenes & Paraffins	—	27.2

What we claim is:—

1. A process for the production of motor gasoline from the polymer produced by the thermal stabilisation of steam cracked naphtha which comprises catalytically hydrogenating said polymer at elevated temperature and pressure, and fractionating the product of the hydrogenation process to yield a gasoline fraction.

2. A process according to claim 1, wherein the product of the hydrogenation process is fractionated to yield in addition a higher boiling fraction rich in aromatics.

3. A process according to claim 1 or 2, wherein said polymer amounts to between 10 and 16% by weight of the cracked naphtha.

4. A process according to any of claims 1 to 3, wherein a lower boiling fraction of the

polymer is subjected to the hydrogenation process.

5. A process according to claim 4, wherein said lower boiling fraction has a boiling range of 200 to 300° C.

6. A process according to any of the preceding claims, which is carried out at a temperature of 650 to 850° F. and a pressure of 500 to 1500 p.s.i.g.

7. A process according to claim 6, which is carried out at a space velocity of up to 10 v/v/hr. of liquid feedstock and a gas recycle rate of up to 10,000 SCF/B.

8. A process according to any of the preceding claims, wherein the hydrogenation catalyst consists of the oxides of cobalt and molybdenum supported on alumina.

9. A process for the production of motor gasoline substantially as hereinbefore described with reference to either of the Examples.

10. Motor gasoline when produced by a process according to any of the preceding claims.

T. MACDONALD,
For the Applicants.

PROVISIONAL SPECIFICATION

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of a further quantity of gasoline which is of high quality.

According to the present invention, the aforesaid polymer or a part thereof is catalytically hydrogenated at elevated temperature and pressure, and the hydrogenated product fractionated for the recovery of a gasoline fraction and a higher boiling fraction rich in aromatics.

According to a further feature of the invention, a lower boiling fraction of the polymer, for example a fraction boiling between 200 and 300° C., is subjected to the hydrogenation process.

Methods of carrying the invention into effect will now be described by way of example only.

EXAMPLE 1.

A steam cracked gasoline was subjected to polymerisation treatment at a pressure of 375 p.s.i.g., a temperature of 200° C. and a residence time of 8 hours. The polymer, which amounted to about 16% wt. on feeds was hydrogenated over a catalyst consisting of the oxides of cobalt and molybdenum on alumina at a pressure of 1000 p.s.i.g., a temperature of 780° F., a space velocity of liquid polymer of 1.0 v/v/hr. and a gas recycle rate of 4000 SCF/B.

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	I.B.P.— 200°C.	200°C.— F.B.P.
	Fraction	Fraction
Yield, % volume	70	30
Octane Number (Research Method clear)	98.1	—
(Micro-Analytical Method)	F.I.A. Method	F.I.A. Method
Hydrocarbon Type Analysis		A.S.T.M. D. 875
Aromatics	57.5	98.0
Olefins	1.0	1.0
Paraffins & Naphthenes	41.5	2.0

EXAMPLE 2.

The same steam cracked gasoline as in Example 1 was subjected to polymerisation treatment under the same conditions as in Example 1. A distillate fraction of the polymer was then hydrofined under the following conditions:—

Pressure	p.s.i.g.	700	
Temperature	° F.	780	10
Space Velocity	v/v/hr.	1.0	
Gas Recycle Rate	SCF/B.	4000	
The polymer distillate fraction had the following properties before and after hydrofining:—			

	Feedstock Distillate Polymer	Hydrogenated Product
Yield on Total Polymer % wt.	50	—
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Naphthenes & Paraffins	—	27.2

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